

FORM PTO-1390 (Modified)
(REV 11-98)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

BKR-21102/01

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/719256

INTERNATIONAL APPLICATION NO.
PCT/GB99/01844INTERNATIONAL FILING DATE
10 June 1999PRIORITY DATE CLAIMED
11 June 1998TITLE OF INVENTION
PAVING BLOCK

APPLICANT(S) FOR DO/EO/US

Peter Hart

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ Certificate of Mailing by Express Mail
20. ☐ Other items or information:

Postcard

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.53) 09/719256		INTERNATIONAL APPLICATION NO. PCT/GB99/01844		ATTORNEY'S DOCKET NUMBER BKR-21102/01	
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21. The following fees are submitted:

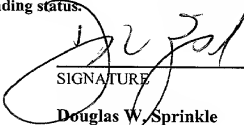
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) : <input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1,000.00 <input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$710.00 <input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00 <input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00				CALCULATIONS PTO USE ONLY	
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$860.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e)).				<input type="checkbox"/> 20 <input type="checkbox"/> 30	
				\$0.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	16 - 20 =	0	x \$18.00	\$0.00	
Independent claims	2 - 3 =	0	x \$80.00	\$0.00	
Multiple Dependent Claims (check if applicable).				<input type="checkbox"/> \$0.00	
TOTAL OF ABOVE CALCULATIONS =				\$860.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable).				<input checked="" type="checkbox"/> \$430.00	
SUBTOTAL =				\$430.00	
Processing fee of \$130.00 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)).				<input type="checkbox"/> 20 <input type="checkbox"/> 30	
				\$0.00	
TOTAL NATIONAL FEE =				\$430.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).				<input checked="" type="checkbox"/> \$40.00	
TOTAL FEES ENCLOSED =				\$470.00	
				Amount to be refunded \$	
				charged \$	

☒ A check in the amount of **\$470.00** to cover the above fees is enclosed.
☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees.
 A duplicate copy of this sheet is enclosed.
☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **07-1180** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Douglas W. Sprinkle
 Gifford, Krass, Groh, Sprinkle,
 Anderson & Citkowski, P.C.
 280 N. Old Woodward Avenue, Suite 400
 Birmingham, MI 48009


 SIGNATURE
 Douglas W. Sprinkle
 NAME
 27,394
 REGISTRATION NUMBER
 December 7, 2000
 DATE

09/719256

JC01 Rec'd PCT/PTO 07 DEC 2000
Attorney Docket No. BKR-21102/01

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Peter Hart

Serial No.:

Filed:

For: PAVING BLOCK

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Prior to the examination of this application, please amend the application
as follows:

IN THE ABSTRACT:

Please insert the abstract on the attached page.

IN THE CLAIMS:

Claim 3, line 1, delete "any preceding"; and
after "claim" insert --1--.

Claim 4, line 1, delete "Claims" and insert --Claim--; and
delete "to 3".

Claim 5, line 1, delete "any preceding"; and
after "Claim" insert --1--.

Claim 6, line 1, delete "any preceding"; and
after "Claim" insert --1--.

Claim 7, line 1, delete "any preceding"; and
after "Claim" insert --1--.

1 8. (Amended) A paving surface for the management of rainwater,
2 floodwater or liquid spillage having a permeable layer on a supporting substrate
3 layer, which supporting substrate layer is permeable to liquid and is of particulate
4 material providing interstitial cavities for receiving rainwater, floodwater or
5 spillage draining through the permeable layer, wherein the permeable layer is
6 constructed at least partially by the close-fitting without joint filling of a plurality
7 of paving blocks, wherein said paving blocks have an upper surface, a lower
8 surface and a side and end lateral surfaces extending between the upper and lower
9 surfaces and contacting in use at least apart of a lateral surface of at least one
10 adjacent paving block, wherein a substantial portion of at least two lateral surfaces
11 of the paving block extending to the upper surface are tapered along the entirety of
12 the edge between the upper surface and the lateral surface, and at least one of the
13 lateral surfaces has a channel providing communication from the upper surface to
14 the lower surface when the block is placed in abutting contact with another block
15 in use thereof [as claimed in any of Claims 1 to 7].

Claim 10, line 1, delete "Claims" and insert --Claim--; and
delete "or 9".

1 11. (Amended) A paving surface according to [any of Claims] Claim 8
2 [to 10], which is additionally provided with a filtering layer between the
3 permeable layer and the substrate layer.

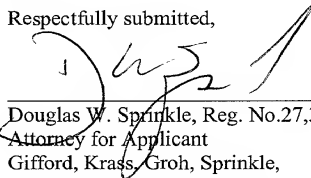
1 13. (Amended) A paving surface according to [any of Claims] Claim 8
2 [to 12], wherein the supporting substrate layer is contained within a containment
3 membrane of impermeable material.

Claim 15, line 1, delete "Claims" and insert --Claim--; and
delete "or 14".

1 16. (Amended) A paving surface as claimed in [any of Claims] Claim
2 8 [to 15], in which the paving blocks are made from an impermeable material.

If the Examiner has any questions relating to the application, Applicant's
attorney may be reached at (248) 647-6000.

Respectfully submitted,



Douglas W. Sprinkle, Reg. No. 27,394
Attorney for Applicant
Gifford, Krass, Groh, Sprinkle,
Anderson & Citkowski, P.C.
280 N. Old Woodward Ave., Suite 400
Birmingham, MI 48009-5394
(248) 647-6000

Date: 12/7/03

DWS/gs
GS-C:\docs\DWS\BKR21102-pre.doc

Abstract

There is disclosed a paving block for use in the construction of a paved surface, which paving block has a top surface, a bottom surface and at least one lateral surface extending between the top and bottom surfaces and abutting in use at least part of a lateral surface of at least one adjacent paving block, wherein a portion of the lateral surface of the paving block adjacent to the top surface is tapered.

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PAVING BLOCK

This application relates to paving blocks for use in the construction of paved surfaces.

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Paved surfaces constructed from individual, discrete paving blocks have an increasingly wide range of applications. The decorative or functional nature of such paving blocks may be detrimentally affected by spalling, that is fragmentation, particularly of their upper faces. This is particularly a problem in paving systems which are constructed by close-fitting of individual paving blocks without any joint filling such as mortar or sand, as the paving blocks in these systems are in contact with one another which can cause fracturing pressures to be exerted upon relative movement of individual paving blocks which take place from time to time due to applied loads from traffic and thermal dilatation from for example diurnal temperature variations.

20

There is an obvious need to reduce the tendency of paved surfaces to deteriorate by spalling, but solutions to this problem are not easily found. The present invention seeks to provide a paving block which will not suffer to the same extent as prior art paving blocks, if at all, from the problem of contact induced spalling.

25

According to a first aspect of the present invention there is provided a paving block for use in the construction of a paved surface, which paving block has a top surface, a bottom surface and at least one lateral surface extending between the top and bottom surfaces and abutting in use at least part of a lateral surface of at least one adjacent paving block, wherein a portion of the lateral surface of the block adjacent the top surface is tapered.

10

By forming a block such that an upper part is tapered, that is with an upper part of a lateral surface inwardly inclining, the paving block can be laid together with a plurality of such blocks to form a paved surface in which if adjacent blocks move against one another there are no direct contact forces at the junction between the top surface and the lateral surfaces since the lateral surfaces of adjacent blocks are in fact held spaced from one another.

20

Although it is preferred that each lateral surface of a paving block is provided with a tapered portion it is possible to envisage embodiments of the invention in which only some of the lateral surfaces are provided with tapered portions. For example, if only two contiguous lateral surfaces of a rectangular paving block are provided with tapered portions it is still possible to lay them with other such paving blocks in such a way that

any two facing lateral surfaces of two adjacent blocks have one tapered portion between them. This may be achieved, for example, with a so-called "herringbone" laying pattern, which is preferred, although others may also be used (for example English bond pattern) and achieve the same objective.

It is also preferred that the tapered portion extend along the entire edge between the or each lateral surface and the top surface. In such cases the paving block is in effect provided with a tapered surface extending between the or each lateral surface and its top surface.

The portion of the lateral surface which is tapered may extend over any desired part of the height i.e. length, of the lateral surface. It is, however, preferred that the portion of the lateral surface which is tapered be greater than 10% and less than 80% of the entire length or height of the lateral surface. More preferably the portion of the lateral surface which is tapered is in the range of 20 to 30 %, e.g. 25%, of the lateral surface.

The angle at which the lateral surface is tapered with respect to the remaining non-tapered portion of the lateral surface may be any suitable angle greater than 0° and less than 90° , but is preferably in the range of greater than 0° to less than 35° , more preferably greater than 0° to less than 15° and most preferably between 5° and

10°.

The dimensions of the portion of the lateral surface which is tapered and the angle of inclination may be the same or different for each lateral surface of the paving block. In one embodiment, which is currently preferred, at least corresponding lateral surfaces, i.e. those on opposing sides, or all lateral sides have a tapered portion of the same dimensions and angle of inclination so that the paving block has a degree of symmetry.

According to a second aspect of the present invention there is provided a paving block for use in the construction of a paved surface, which paving block has a top surface, a bottom surface and lateral surfaces extending between the top and bottom surfaces, in which at least one of the lateral surfaces has a channel extending substantially from the top to the bottom surface whereby to provide a drainage path for surface water or other liquid through the channel when the paving block is laid with other such paving blocks to form a paved surface.

The block may be provided with a channel in only one of its surfaces. Alternatively more than one lateral surface of the block may be provided with a channel. Each and all lateral surfaces of the paving block may have at least one such channel particularly for regularly shaped paving

blocks, e.g. cuboid blocks. The channels provided on a block may have the same or different shapes or dimensions. The shape and dimensions of the channel should be such as to allow an adequate drainage rate for which they should provide a significant cross-sectional area for drainage. Suitable shapes include irregular cross-sectional shapes or regular ones including semi-circular or square-cut or rectangular-cut channels. The or each channel may be wider than it is deep and the depth preferably is not greater than around 1cm. More particularly the depth of the channel is preferably not greater than, or at most not much greater than about 5mm or 4mm such that the maximum width of a drainage opening formed by two channels in register on facing lateral surfaces of adjacent blocks is approximately 1cm or less.

The channel may be located at any desired position along the lateral surface, which position may be the same or different for each lateral surface of a block. It is preferred that the channel be positioned for ease of registration with a corresponding channel on an adjacent block. For this purpose the channel may be provided at a central location on one, some or all of the lateral surfaces.

25

Paving blocks formed in accordance with this aspect of the invention may be made from a permeable or an impermeable material although impermeable material is

preferred as this may be stronger and therefore better able to withstand heavier specific loads.

In one embodiment of the invention the paving block also
5 has at least one lateral surface with a tapered portion at or adjacent the region thereof where it joins the top surface of the paving block. Two or more such tapered lateral surfaces may be provided and in the currently most preferred embodiment the block has tapered portions
10 on all lateral surfaces and at least one channel in one or two of the tapered lateral surfaces. The or each channel may extend in such cases from the bottom surface through the tapered section to the top surface. Alternatively the, some or each channel on a block may
15 extend only to the junction of the tapered section and the non-tapered section. The tapered section may have the additional function in use of funnelling water into the drainage channel.

20 Suitable materials from which the paving block of the present invention may be manufactured will be well known to the skilled man and will be chosen to suit the particular application for which the paving block is to be utilised. Suitable materials include fired clay,
25 concrete and the like. It is preferred that the paving block be made from a suitable sound material which has satisfactory mechanical properties such as compressive strength and flexural strength as well as abrasion

resistance, high slip/skid resistance and good frost resistance.

Suitable dimensions and shapes for the paving block will
5 also be well known to the skilled man and will be determined by the particular application for which the paving block is to be utilised. In general, the paving block should have sufficient depth, i.e. the height or length of the lateral surfaces should be sufficient, to
10 ensure dispersion of concentrated loads applied to the paved surface in which the paving block is utilised and in particular should be sufficient to prevent them from tilting under load in situations where they are close-fitted without mortar or sand joint and therefore have
15 relative lateral freedom with respect to adjacent paving blocks.

The paving block may be shaped, configured, patterned or ornamented as desired according to practices well known
20 in the art. Polygonal cross-sectional shapes are preferred particularly those allowing easy tessellation for paved surfaces. The top surface of the paving block may be provided with a chamfered edge, for example, at least where it joins the tapered portion of a lateral
25 surface.

The paving block may be used in a wide range of applications including use in a paving system forming

part of an industrial estate, a retail or shopping centre, a car park, a lorry park, a driveway, a pedestrian walkway, or for other hard landscaping such as playgrounds etc.

5

The paving block may particularly be used in paving systems designed for rainwater, flood or spillage management. Such systems, as are described in WO96/12067, are of use in situations where there is a risk of fluid
10 spillage, for example of hazardous chemicals, and there is a desire or need to prevent them from entering existing drainage systems which would allow them to pass uncontrolled into the environment without preliminary treatment or in situations where there is a risk of
15 flooding, for example, by flash storms which overload existing rain or storm water provisions. Such paving systems have a permeable surface on top of a containment system capable of retaining fluid which has drained through the permeable layer. The permeable or porous
20 surface is constructed from a permeable material, e.g. paving blocks which are either porous or are provided with small drainage channels or holes and close-fitted together without mortar or sand joint. Spalling can occur in such systems not only due to the action of
25 weather but by relative movement of the individual paving blocks especially tilting under the action of an applied load.

According to a third aspect of the present invention there is provided a paving system for rainwater, flood or spillage management having a permeable layer on a supporting substrate layer, which supporting substrate layer is permeable to liquid, and is of particulate material providing interstitial cavities for receiving rainwater, floodwater or spillage draining through the permeable layer, wherein the permeable layer is constructed at least partially by the close-fitting
5 layer without joint filling of a plurality of paving blocks each of which has a top surface, a bottom surface and at least one lateral surface extending between the top and bottom surfaces and abutting in use at least part of a lateral surface of at least one adjacent paving block,
10 wherein a portion of the lateral surface of the block adjacent the top surface is tapered.

The paving system according to the third aspect of the present invention is easy and cheap to lay, allows the permeable paving layer to be easily lifted when required,
20 e.g. for examination, flushing, cleaning or substitution, and is resistant to deterioration caused by spalling of the paving blocks. It has been found that tapering, that is inwardly inclining, an upper portion of the lateral surface of at least some of the paving blocks allows a
25 plurality of such blocks when laid to form a paved surface to move more easily against one another without causing contact damage or spalling of the top surface.

Such blocks are hereinafter referred to as tapered paving blocks and may be substantially as hereinbefore described with regard to the first aspect of the invention.

5 The permeable layer is at least partially but may be fully formed from tapered paving blocks. Where it is formed only partially from tapered paving blocks the remainder of the permeable layer may be formed as a single sheet of porous material or material made porous
10 by the provision of drainage holes or channels or alternatively or additionally the remainder may be formed by discrete paving blocks, preferably laid close-fitting without a joint filling such as mortar or sand some or all of which may be substantially as described above for
15 the second aspect of the invention.

Suitable materials from which the conventional or tapered paving blocks may be manufactured will be well known to the skilled man and will be chosen to suit the particular
20 application for which the paving system is to be utilised. Suitable materials include fired clay, concrete and the like. It is preferred that some or all of the paving blocks be made from a suitably sound material which has satisfactory mechanical properties
25 such as compressive strength and flexural strength as well as abrasion resistance, high slip/skid resistance and good frost resistance. Some or all of the paving blocks may also be made of a porous material such as a

porous concrete or alternatively they may be provided with drainage holes or drainage channels located, for example, to extend along the height of a lateral side. The design of the permeable layer will depend in part on
5 whether a porous or infiltration paving system is required.

According to a fourth aspect of the invention there is provided a paving system for rainwater, flood or spillage
10 management having a permeable layer on a supporting substrate layer, which supporting substrate layer is permeable to liquid and is of particulate material providing interstitial cavities for receiving rainwater, floodwater or spillage draining through the permeable
15 layer, wherein the permeable layer is constructed at least partially by the close-fitting without joint filling of a plurality of paving blocks each of which has a top surface, a bottom surface and lateral surfaces extending between the top and bottom surfaces, in which
20 at least one of the lateral surfaces has a channel extending substantially from the top to the bottom surface whereby to provide a drainage path for surface water or other liquid through the channel when the paving block is laid with other such paving blocks to form a
25 paved surface.

Suitable blocks for the fourth aspect of the invention may be substantially as described above for the second

aspect of the present invention.

The substrate layer of the paving system is formed from particulate material to provide interstitial cavities in which draining spillage or water can dwell after passage through the permeable layer. The particulate material preferably has a particle size of 15 mm or greater and may have an upper size range of 200 mm to 300 mm. It preferably is of a material which is substantially inert to water, non-friable and frost resistant. Suitable materials include crushed stone, pebbles and blast furnace slag, but other materials are suitable and the choice both of the material and its size and shape (which affect the storage and release capability of the system) will depend upon the particular application of the paving system.

The paving system may additionally be provided with a filtering layer preferably situated between the permeable layer and the substrate layer. The filtering layer should be capable of filtering solids, e.g. debris, waste, etc, from fluids which have passed through the permeable layer. The filtering layer may be a geotextile layer and between 1 mm and 1.5 mm in thickness.

25

There may also be provided a dispersing layer for dispersing or distributing water or spillage which has passed through the permeable layer over the filtering

layer. The dispersing layer may be a bed of gravel, crushed gravel or other small grained particulate material having a particle size preferably between 5 mm to 10 mm in diameter. The dispersing layer not only
5 helps to disperse fluid over the filtering layer, but also provides an initial screening of that fluid to minimise clogging of the layers beneath and in addition can provide a flat surface for the laying of permeable layer.

10

The paving system is preferably capable of the in situ processing or treatment of water or spillage contained within the system after it has passed through the permeable layer. For this purpose prophylactic or
15 remedial chemicals or bacteria may be introduced or stored within the paving system. The paving system may be such that such chemicals or bacteria introduced or stored are restricted to certain contained sections of the system. In this way water may be treated or
20 hazardous fluids can be rendered harmless before they become dispersed from the system. To assist in the biological decomposition of material passing through the permeable layer 'nests' may be provided within the system where a suitable environment is provided for appropriate
25 bacteria. If necessary required nutrients may be supplied via the permeable layer.

The supporting substrate layer may be contained within a

containment membrane of impermeable material. In such cases the containment membrane forms in effect a tank or channel for fluid passing through the permeable layer. Weirs or dividers may be provided to isolate sections of the tank or channel. Such weirs may be permeable, for example, where they are to be used in floodwater control, or impermeable, for example, where they are to be used for chemical or biological processing. They may be an integral part of the containment membrane or separate therefrom.

The paving system may be provided with means for draining off fluid contained within the containment membrane. There may, for example, be provided suitably positioned valves or discharge ducts.

There may also be provided means for enabling gas, such as atmospheric air, to be drawn through at least the substrate layer.

The paving system is advantageously constructed so that all of its elements can be easily lifted out for examination, flushing, cleaning or replacement if required.

The paving system may be used in a wide range of applications including use in a paving system forming part of an industrial estate, a retail or shopping

centre, a car park, a lorry park, a refuelling station, a chemical loading bay, a driveway, a pedestrian walkway, a playground or for other hard landscaping where porous rainwater, flood or spillage management may be required.

5

For a better understanding of the present invention and to show how the same may be put into effect reference will now be made, for the purpose of illustration only, to the accompanying drawings in which:

10 Figure 1 is a perspective view of a paving block formed as a first embodiment of the present invention;

 Figure 2 is a side view of the paving block of Figure 1;

 Figure 3 is a plan view of the paving block of Figure 1;

15 Figure 4 is an end view of the paving block of Figure 1;

 Figure 5 is an enlarged detail of part of the paving block of Figure 1;

20 Figure 6 is a plan view of a paving block formed as a second embodiment of the present invention;

 Figure 7 is a side view of the paving block shown in Figure 6;

 Figure 8 is a detail in enlarged section taken on
25 the line VII-VII of Figure 6;

 Figure 9 is a plan view of a third embodiment of a paving block of the present invention;

 Figure 10 is a schematic transverse cross-section

through a paving system according to the present invention; and

Figure 11 is a schematical longitudinal cross-section through the paving system of Figure 10.

5

The paving block illustrated in Figures 1 to 5 is a substantially cuboid paving block 1 having a length (dimension 2) of 200mm, a width (dimension 3) of 100mm and a height (dimension 4) of 80mm. The paving block 1
10 has a substantially rectangular bottom surface 5, a substantially rectangular top surface 6 and two pairs of substantially rectangular opposing lateral surfaces 7.

Each lateral surface 7 is provided with a portion 8 which
15 tapers inwardly towards the top surface 6. The height (dimension 9) of the tapered portion 8 of the lateral surface 7 is 20mm, i.e. it extends for approximately 25% of the overall height (dimension 4) of the lateral surface 7. The angle at which the tapered surface 8
20 extends with respect to the lateral surface 7 is approximately 5° to 10° so that it extends inwardly for about 1mm to 2mm, e.g. approximately 1.5mm.

The top surface 6 is provided with a chamfer 10 which
25 extends inwardly from a narrow shoulder 11 extending around the periphery of the top surface 6 at its common edge with the tapered portions 8 of the lateral surfaces 7. The chamfer 10 is inclined at an angle of between 30°

to 40°, e.g. approximately 35°, with respect to the top surface 6. The shoulder 11 and chamfer 10 extend inwardly for about 5mm to 6mm, e.g. approximately 5.5mm.

5 The paving block is of particular use in paving systems where discrete paving blocks are laid close-fitting without mortar or sand joint. In such situations the tapering of the uppermost section of the lateral, i.e. abutting, surfaces of the paving block allows the paving
10 blocks to move more easily against one another without giving rise to spalling on the top surface of the paving block.

Referring now to Figures 6 to 8, the paving block shown
15 is an alternative embodiment of the invention and where possible the same reference numerals have been used to identify the same or corresponding parts thereof.

Like the paving block illustrated in Figures 1 to 5, the
20 paving block illustrated in Figures 6 to 8 is substantially cuboid and may have the same dimensions as described in relation to the embodiment of Figures 1 to 5. This embodiment differs in that the lateral surface 7 at the side of the block has a shallow channel 15
25 extending from a position close to the top surface 6 across the entire height of the lateral surface 7. As shown in Figures 6 to 8, this channel is centrally located in relation to the length 2 of the paving block

and a corresponding channel 16 is formed in the opposite lateral surface. Likewise, approximately centrally of the lateral surfaces 7 at the end of the paving block 1 there are formed respective channels 17, 18 having substantially the same dimensions as those of the channels 15, 16.

The depth of the channels 15-18 is approximately 5mm such that should two such channels of adjacent blocks having facing surfaces be in register the maximum width would be about 10mm, which is less than the smallest dimension of a heel likely to be encountered. The channels 15-17 nevertheless provide a significant cross-sectional area for drainage of surface water on a paved surface formed by laying the blocks 1 such that it is possible to obtain an adequate drainage rate without making the blocks of permeable material. The use of an impermeable material has advantages in the provision of greater structural strength and resistance to compressive loads so that such impermeable blocks may be used in circumstances, such as lorry parks, where the applied loading may be considerable. As in the embodiment of Figures 1 to 5, paving blocks formed in accordance with Figures 6 to 8 may be laid close-fitting without mortar or sand joint with the tapered portion uppermost. Such blocks provide a high degree of drainage through the otherwise impermeable surface and, due to the presence of the tapered upper portion of the lateral surfaces, any slight

rocking of the blocks as traffic passes over them will be permitted without causing spalling or fracture at the upper surface.

- 5 The paving block 19 illustrated in Figure 9 has an irregular polygonal cross-sectional shape which shape is formed from three basic irregular polygonal shapes 20 arranged into a L or V shape by placing two of the basic shapes 20 at adjacent sides of the other basic shape 20.
- 10 The top surface 21 of the block 19 is provided with two indented lines 22, 23 to give the block 19 the appearance of being made up of three individual blocks of the basic shape. The basic shape 20 is based on a square cross-section. Each of the lateral sides 24, 25, 26 of the
- 15 basic shape 20 is formed from three mutually inclined surfaces placed in a zig-zag configuration and each has a tapered section 27 which inclines towards the top surface 21. The lateral surfaces 25 are provided with a semi-circular cylindrical drainage channel 28 located in
- 20 the middle one of the mutually inclined surfaces. Additional drainage channels 29 are formed on adjacent mutually inclined end surfaces of the lateral surfaces 26.
- 25 The paving system of Figures 10 and 11 has a permeable layer 30 (shown schematically) which is formed at least partially from a plurality of tapered paving blocks 1 as shown in Figures 1 to 5, a plurality of channel paving

blocks as shown in Figures 6 to 9 or a combination thereof. The permeable layer 30 is laid upon a dispersing layer 31 formed as a bed of relatively fine gravel. Beneath the dispersing layer 31 lies a filtering layer 32 formed from a geotextile. Beneath the filtering layer 32 lies a supporting substrate layer 33 formed from a relatively coarse particulate material. In this embodiment all of the layers (30 to 33) are contained within a containment membrane 34 of impermeable material which extends beneath all of the layers (30 to 33), up the sides of the dispersing 31, filtering 32 and substrate 33 layers, and then a portion 35 extends outwardly for a short distance away from the permeable layer 30 and is held in place by suitable means such as border blocks or stones 36. In other embodiments (not shown) the containment membrane may be omitted, particularly if the installation site has a geological structure which permits free drainage.

A U-shaped frame 37 positioned around and below the containment membrane 34 is used to retain a divider or weir 38 as shown in Figure 11. The bottom edge of the weir 38 is received within the U-shaped frame 37 and traps the containment membrane 34 therebetween. The weir 38 is supported by the substrate layer 33 and extends through at least a portion of the height of the substrate layer 33. A difference in fluid levels on either side of the weir is indicated by the arrows 39. A drain valve 40

and an outlet pipe 41 are provided close to the weir and extend through the containment membrane 34. The valve 40 could be formed as an integral part of the U-shaped frame 37 if desired.

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In use fluid, e.g. spillage or rainwater, passes into the system through the porous surface 30. The fluid is evenly distributed over the area of the system by the dispersing layer 31. Solids are filtered out by the
10 filtering layer 32 and are then retained or stored within the interstices of the substrate layer 33 where they may undergo preliminary treatment if required, in particular the biological action of bacteria resident in the interstices in the coarse particle material of which the
15 layer 33 is composed. Such bacteria may in fact migrate to the filtering layer 32 to act on materials filtered out of the water passing through the filter in use of the system, especially in periods of high utilisation when the interstices of the material 33 may be flooded or
20 flushed with water through a system. When desired fluid may be drained in a controlled manner from the system via valve 40 and outlet pipe 41.

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CLAIMS

1. A paving block for use in the construction of a paved surface, which paving block has an upper surface,
5 a lower surface and side and end lateral surfaces extending between the upper and lower surfaces and contacting in use at least part of a lateral surface of at least one adjacent paving block, wherein a substantial portion of at least two lateral surfaces of the paving
10 block extending to the upper surface are tapered along the entirety of the edge between the upper surface and the lateral surface, and at least one of the lateral surfaces has a channel providing communication from the upper surface to the lower surface when the block is
15 placed in abutting contact with another block in use thereof.

2. A paving block according to Claim 1, wherein the portion of a lateral surface which is tapered extends
20 over 10% to 80% of the entire height of the lateral surface.

3. A paving block according to any preceding claim, wherein the angle at which the tapered portion extends
25 with respect to the remaining portion of the lateral

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surface is greater than 0° and less than 15°.

4. A paving block as claimed in any of Claims 1 to 3,
in which all lateral surfaces of the paving block have at
5 least one channel therein.

5. A paving block as claimed in any preceding Claim, in
which the or each channel is wider than it is deep.

10 6. A paving block as claimed in any preceding Claim in
which the depth of the or each channel is not greater
than about 5mm.

7. A paving block as claimed in any preceding Claim in
15 which the material from which the block is made is
impermeable.

8. A paving surface for the management of rainwater,
floodwater or liquid spillage having a permeable layer on
20 a supporting substrate layer, which supporting substrate
layer is permeable to liquid and is of particulate
material providing interstitial cavities for receiving
rainwater, floodwater or spillage draining through the
permeable layer, wherein the permeable layer is
25 constructed at least partially by the close-fitting

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without joint filling of a plurality of paving blocks as claimed in any of Claims 1 to 7.

9. A paving surface according to Claim 8, wherein the permeable layer is formed substantially entirely by tapered paving blocks.

10. A paving surface according to Claims 8 or 9, wherein the permeable layer is formed from a mixture of tapered paving blocks and conventional paving blocks.

11. A paving surface according to any of Claims 8 to 10, which is additionally provided with a filtering layer between the permeable layer and the substrate layer.

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12. A paving surface according to Claim 11, which is additionally provided with a dispersing layer between the permeable layer and the filtering layer.

20 13. A paving surface according to any of Claims 8 to 12, wherein the supporting substrate layer is contained within a containment membrane of impermeable material.

14. A paving surface according to Claim 13, which is provided with one or more dividing means for dividing

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sections within the containment membrane.

15. A paving surface according to Claims 13 or 14,
wherein means are provided for the drainage of fluid
5 contained within the containment membrane.

16. A paving surface as claimed in any of Claims 8 to
15, in which the paving blocks are made from an
impermeable material.

1/7

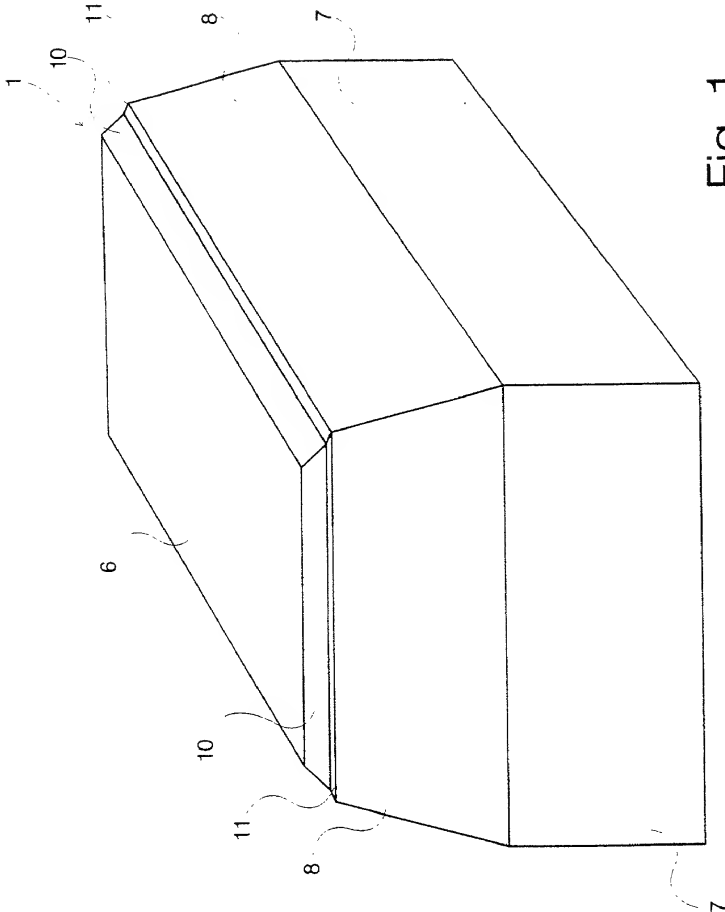


Fig. 1

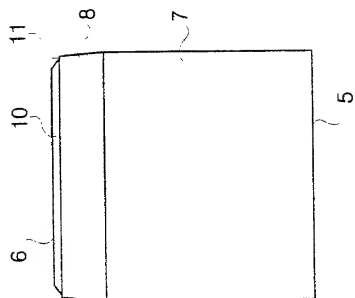


Fig. 4

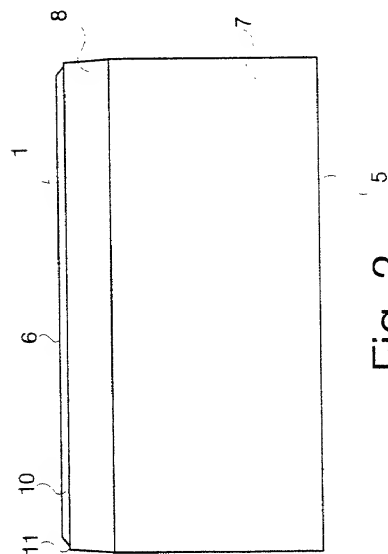


Fig. 2

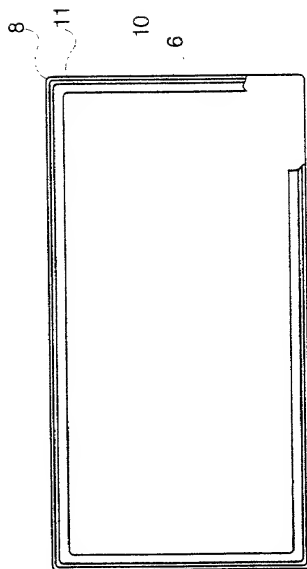


Fig. 3

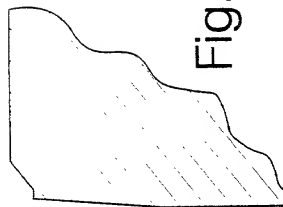


Fig. 5

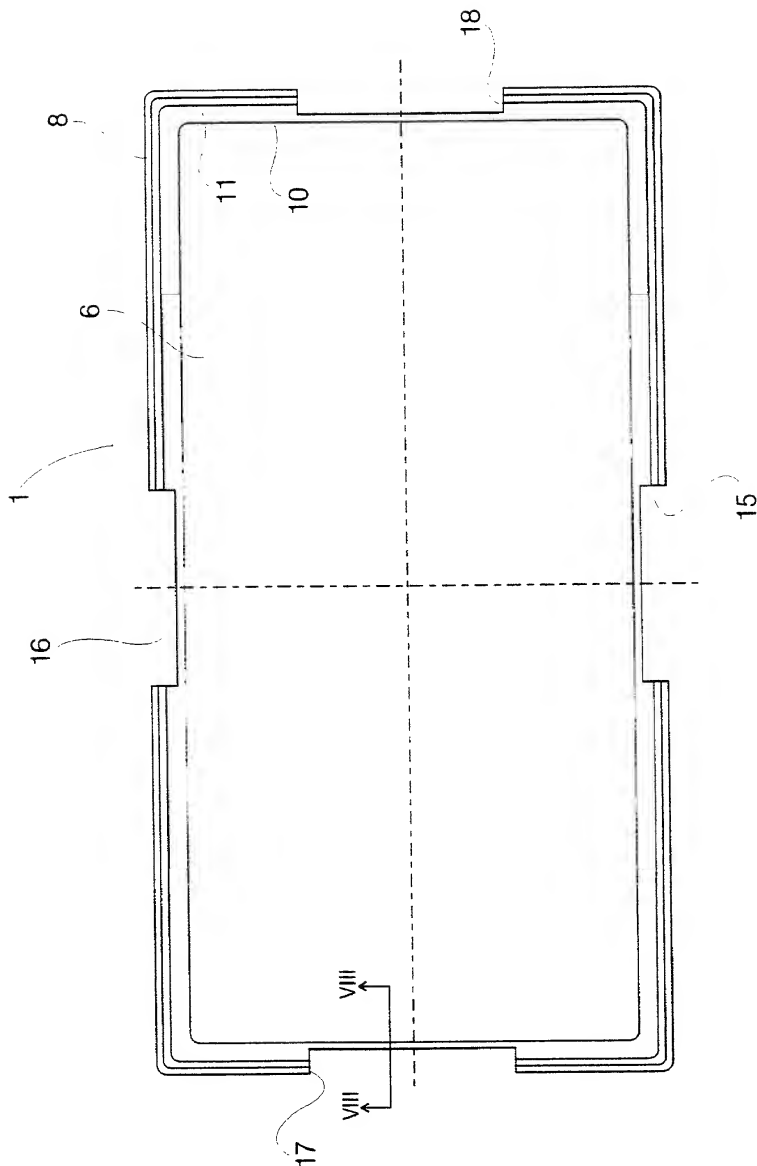


Fig. 6

4/7

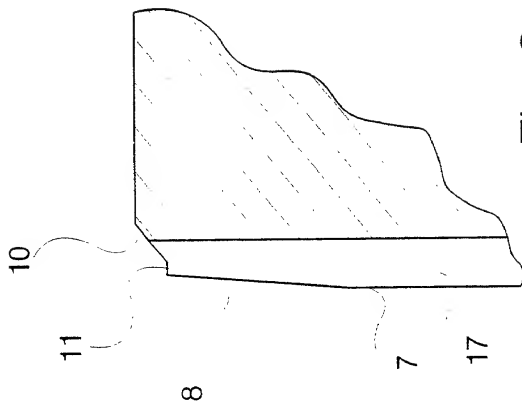


Fig. 8

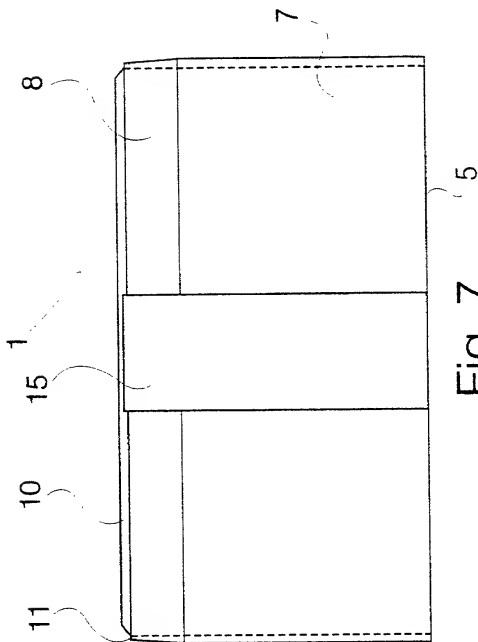


Fig. 7

5/7

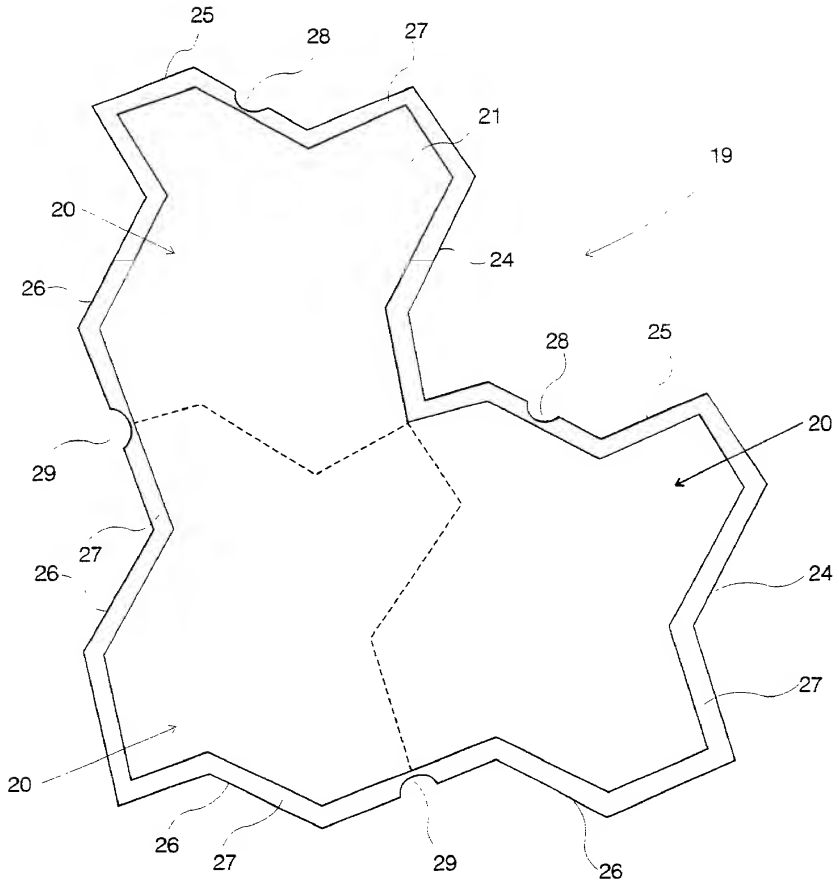


Fig. 9

6/7

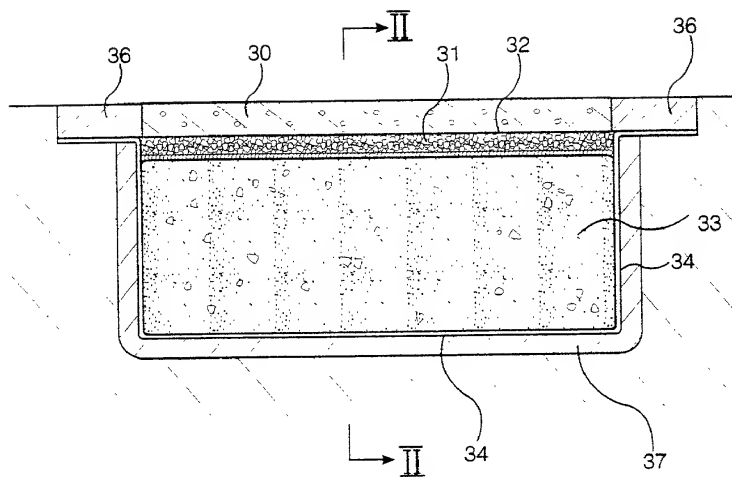


Fig. 10

7/7

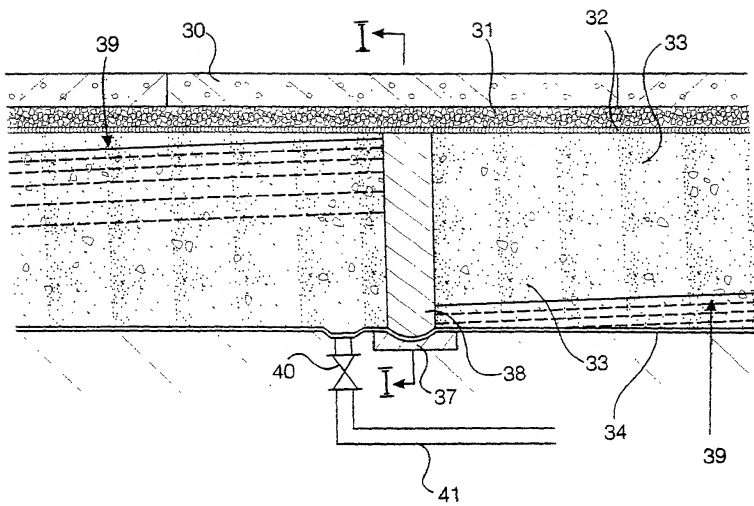


Fig. 11

COMBINED DECLARATION, POWER OF ATTORNEY AND PETITION

As a below named inventor, I hereby declare: my residence, post office address and citizenship are as stated below next to my name; and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: A Paving Block the specification of which

[] is attached hereto.
 [] was filed on _____ as Application Serial No. _____ and
 was amended on _____ (if applicable).
 [X] was described and claimed in PCT International Application No. PCT/GB99/01844
 filed on 10th June, 1999 and as amended under PCT Article 34 on 5th July, 2000.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, S1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code S119 of any foreign application(s) for patent or inventor's certificates listed below and have also identified below any foreign application on which priority is claimed:

PRIORITY CLAIMED

YES NO

[X] []

<u>9812462.1</u>	<u>GB</u>	<u>11th June 1998</u>
<u>9817498.0</u>	<u>GB</u>	<u>12th August 1998</u>
(Number)	(Country)	(Day, month, year filed)

I hereby claim the benefit under Title 35, United States Code S120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, S112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, S1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

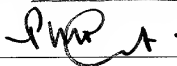
(Application Serial No.) (Filing Date) (Status) (Patented, pending, abandoned)

And I hereby appoint the firm of Gifford, Krass, Groh, Sprinkle, Patmore, Anderson and Citowski, P.C., a firm composed of Ernest I Gifford, PO Reg. 20,644; Allen M. Krass, PO Reg. No. 18,277; Irvin L. Groh, PO Reg. No. 17,505; Douglas W. Sprinkle, PO Reg. No. 27,394; Alfred L. Patmore, Jr., PO Reg. No. 19,145; Thomas E. Anderson, PO Reg. No. 31,318; Ronald W. Citowski, PO Reg. No. 31,005; Judith M. Riley, PO Reg. No. 31,561; Theresa A. Orr, PO Reg. No. 34,890; Douglas J. McEvoy, PO Reg. No. 34,385; Ellen Cogen Lipton, PO Reg. No. 38,109; Roberta J. Morris, PO Reg. No. 33,196 and John G. Posa, Patent Agent, P.O. Reg. No. 37,424 all members in good standing before their respective bars, having their address at 280 North Woodward, Suite 400, Birmingham, Michigan 48009 as my attorneys, to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith. Send all correspondence to: Douglas W. Sprinkle, 280 N. Woodward, Suite 400, Birmingham, Michigan, 48009; Telephone No. 313 647-6000.

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application of any patent issued thereon.

100
Full name of sole or first inventor PETER LESLIE HART

Inventor's signature 

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